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ABSTRACT

Successful experimental programs, in which teachers have been trained to increase their students' academic achievement, were analyzed to identify common teacher functions. Six recent studies in which teachers implemented training and in which students had higher achievement were examined. Conclusions drawn from the analysis include: (1) Students taught with structured curricula do better than those taught with individualized or discovery learning approaches; and (2) Students who received their instruction directly from the teacher achieved more than those expected to learn new material or skills on their own or from each other. A list of specific teaching functions that promote learning was developed from this study: (1) daily reviewing, checking previous day's work, reteaching if necessary, and checking homework; (2) providing overviews in new content/skills, proceeding in small steps (but at a rapid pace if necessary), giving detailed or redundant instructions and explanations, and phasing in new skills while old skills are being mastered; (3) high frequency of questions and overt student practice, prompting during initial learning, and feedback allowing student response; (4) giving feedback and correctives, recycling instruction if necessary, and making corrections by simplifying questions, giving clues, explaining, and reviewing; (5) providing time for independent practice and seatwork until students are sure of material; and (6) providing weekly and monthly reviews and reteaching if necessary. (JD)

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Teaching Functions in Successful Teaching Programs

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In the past five years our knowledge of successful teaching has increased considerably. There have been numerous, successful, experimental studies in which teachers have been trained to increase the academic achievement of their students. In these studies, which have taken place in regular classrooms, one group of teachers received training in specific instructional procedures and one group continued their regular teaching. In the successful studies the teachers implemented the training and, as a result, their students had higher achievement and/or higher academic engaged time than did students in the classrooms of the untrained teachers. Particularly noteworthy studies include:

Texas First Grade Reading Group Study (Anderson, Evertson, Brophy, 1979, 1982)

Missouri Mathematics Effectiveness Study (Good and Grouws, 1979) (for math in intermediate grades)

The Texas Elementary School Study (Evertson, Emmer, et al., 1981)

The Texas Junior High School Study (Emmer, Evertson, et al., 1982)

Organizing and Instructing High School Classes (Fitzpatrick, 1981, 1982)

Exemplary Centers for Reading Instruction (ECRI) (Reid, 1978, 1979, 1980, 1981) (for reading in grades 1-5)

Direct Instruction Follow Through Program (Distar) (Becker, 1977).

For example, in the study by Good and Grouws (1979) forty fourth-grade teachers were divided into two groups. One group, of twenty-one teachers, received a 45-page manual which contained a system of sequential, instructional behaviors for teaching mathematics. The teachers read the manual, received two ninety minute training sessions, and proceeded to implement the key in-

structional behaviors in their teaching of mathematics. The control teachers did not receive the manual and were told to continue to instruct in their own style. During the four months of the program all teachers were observed six times.

The results showed that the teachers in the treatment group implemented many of the key instructional behaviors and, in many areas, behaved significantly differently from the teachers in the control group. For example, the treatment teachers were much higher in conducting review, checking homework, actively engaging students in seatwork, and making homework assignments. The results also showed that the test scores in mathematics for students of the treatment teachers increased significantly more than did the scores for students of the control teachers.

Fitzpatrick (1982) conducted a similar study involving ninth grade algebra and foreign language. Twenty teachers were divided into two groups, and the treatment group received a manual explaining and giving teaching suggestions on thirteen instructional principles. The treatment group met twice to discuss the manual. All teachers were observed five times in one of their classrooms.

The results showed that the treatment teachers implemented many of the principles more frequently than did the control teachers. For example, the treatment teachers were higher in attending to inappropriate student behavior, commanding attention of all students, providing immediate feedback and evaluation, having fewer interruptions, setting clear expectations, and having a warm and supportive environment. In addition, overall student engagement was higher in the classrooms of the treatment teachers.

The other programs cited above were similar to these two. I would urge educators to use the manuals and training materials from these programs in preservice and inservice training. Four of the manuals are useful for general

Instruction (Good and Grouws, 1979; Evertson, Emmer et al., 1982; Emmer, Evertson, et al., 1982; Fitzpatrick, 1982). The manual by Anderson, Evertson, and Brophy (1982) is oriented primarily toward instruction in elementary reading groups, and the program by Reid (1978-1981) and by Englemann (Becker, 1977) includes both general instructional methods and highly specific procedures for teaching reading.

The purpose of this paper is to study these successful teacher training and student achievement programs and identify the common functions which appear across these programs. These teaching functions form a general model of effective instruction, which will be discussed below. The model is also useful as a heuristic; it aids in thinking about teaching and is suggesting areas for future research.

An overview of effective instruction

The studies cited above, as well as the correlational studies which preceded them, indicate that, in general, students taught with structured curricula do better than those taught with more individualized or discovery learning approaches, and those who receive their instruction directly from the teacher achieve more than those expected to learn new material or skills on their own or from each other. In general, to the extent that students are younger, slower, and/or have little prior background, teachers are most effective when they:

- structure the learning
- proceed in small steps but at a brisk pace
- give detailed and redundant instructions and explanations
- provide many examples
- ask a large number of questions and provide overt, active practice
- provide feedback and corrections, particularly in the initial stages of learning new material

have a student success rate of eighty percent or higher in
initial learning

divide seatwork assignments into smaller assignments

provide for frequent monitoring during seatwork

provide for continued student practice so that students have a
success rate of ninety to 100 percent and become rapid,
confident, and firm.

It is most important that younger students master content to the point of overlearning. Basic skills (arithmetic and decoding) are taught hierarchically so that success at any level requires application of knowledge and skills mastered earlier. Typically, students are not able to retain and apply knowledge and skills unless they have been mastered to the point of overlearning--to the point where they are automatic. The high student success rates seen in classrooms of effective teachers and programs are obtained because initial instruction proceeds in small steps that are not too difficult and also because teachers see that students practice new knowledge and skills until they are overlearned. (Bryant, 1982).

Overlearning basic skills is also necessary for higher cognitive processing. In a discussion of beginning reading, Beck (1978) noted that data support the position that the brain is a limited capacity processor and that if a reader has to spend energy decoding a word (whether through phonics or context) then there is less energy available to comprehend in the sentence in which the word appears. Similarly, Greeno (1978) noted that mathematical problem solving is enhanced when the basic skills are overlearned and become automatic. In simpler terms, successful learning requires a large amount of successful practice.

Surprisingly, these general procedures also work for older, skilled learners. As part of an introductory physics course at Berkely for students

with interests in biology and medicine, Larkin and Reif (1976) developed a program to teach the skills of studying scientific texts. The experimental students read the material, answered questions, and received ancillary instruction when they made errors so that ultimately all students mastered the material. Later in the course, all students read new material on marketing and new material on gravitational force and answered questions on each passage. Students who received direct instruction in studying scientific text performed better than the controls on each set of material. They concluded:

"Providing direct instruction in a general learning skill is a reliable way to help students become more independent learners. The results described here indicate that students do not automatically acquire a learning skill merely through experience in a subject matter. To enhance independent learning, learning skills should be taught directly." (Larkin and Reif, 1976, p. 439).

The instructional procedures for teaching these physics students were quite similar to those described for young learners. The primary differences were that the size of steps was larger, and the number of questions were fewer.

Thus, across a number of studies we find:

- a) a general pattern of effective instruction that is common across an increasing number of studies,
- b) an advantage to direct, explicit instruction--even explicit instruction in becoming independent learners, and
- c) the importance of overlearning, particularly for hierarchically organized material.

Teaching Functions

Putting together ideas from all the studies cited on page 1, I developed the list of six instructional "functions" which appear in Table 1:

1. Review, checking previous day's work (and reteaching, if necessary)
2. Presenting new content/skills
3. Initial student practice (and checking for understanding)

4. Feedback and correctives (and reteaching, if necessary)
5. Student independent practice
6. Weekly and monthly reviews

These functions are presented in more detail in Table 1, and will be discussed in the remainder of the paper.

There is no hard fast dogma here. It is quite possible to make a reasonable list of 4 or 6 or 8 functions; however, these functions are meant to serve as a guide for discussing the general nature of effective instruction.

There is some difference in the time teachers spend on these functions in lower and upper grades. In the lower grades, particularly in reading and math, the amount of time spent presenting new material is relatively small, and much more time is spent in student practice (through teacher questions and student answers). In later grades, the time spent in presentation becomes longer and the teacher-directed practice becomes shorter.

Table 1
INSTRUCTIONAL FUNCTIONS

1. Daily review, checking previous day's work, and reteaching (if necessary).
 - checking homework
 - reteaching areas where there were student errors
2. Presenting new content/skills
 - provide overview
 - proceed in small steps, (if necessary), but at a rapid pace
 - if necessary, give detailed or redundant instructions and explanations
 - new skills are phased in while old skills are being mastered
3. Initial student practice
 - high frequency of questions and overt student practice (from teacher and materials)
 - prompts are provided during initial learning (when appropriate)
 - all students have a chance to respond and receive feedback
 - teacher checks for understanding by evaluating student responses
 - continue practice until students are firm
 - success rate of 80% or higher during initial learning
4. Feedback and correctives (and recycling of instruction, if necessary)
 - Feedback to students, particularly when they are correct but hesitant.
 - Student errors provide feedback to the teacher that corrections and/or reteaching is necessary.
 - Corrections by simplifying question, giving clues, explaining or reviewing steps, or reteaching last steps.
 - When necessary, reteach using smaller steps.
5. Independent practice so that students are firm and automatic
 - seatwork
 - unitization and automaticity (practice to overlearning)
 - need for procedure to insure student engagement during seatwork (i.e., teacher or aide monitoring)
 - 95% correct or higher
6. Weekly and monthly reviews
 - reteaching, if necessary

Note: With older, more mature learners then (a) the size of step in the presentation is larger, (b) student practice is more covert and (c) the practice involves covert rehearsal, restating, and reviewing (i.e., deep processing or "whirling").

1. Daily review and checking previous work.

The goal of the review at the start of the lesson is making sure that the students are firm in the prerequisite for today's lesson. Activities include: teacher reviewing the concepts and skills necessary to do the homework; having students correct each others papers; giving the teacher feedback on homework items where the students had difficulty or made errors; and reteaching or providing additional practice where necessary.

There are many ways in which this function can be carried out: the teacher can ask questions, students can check each other's papers, and students can reteach each other. However, the important point is that the function is carried out - particularly if the instruction is hierarchical. In elementary grades, this function occurs when the teacher reviews word lists, word sounds, number facts, and mathematical procedures.

The idea of beginning a lesson by checking the previous day's assignment appears in the experimental study of Good and Grouws (1979) and is found again in the work of Emmer et al. (1982). Each of these programs was designed for grades 4-8. In primary grades, such checking and reteaching is explicitly part of the Distar program (Becker, 1977) and the ECRI program (Reid, 1978).

One would have thought that the teacher's daily review and checking of homework is common practice. Yet, in the Missouri Math program (Good and Grouws, 1979) where daily review was included in the training manual given to the treatment teachers, the treatment teachers conducted review and checked homework eighty percent of the time, whereas the control teachers did this only fifty percent of the time.

2. Presentation of material to be learned.

All teachers, of course, do ~~some~~ demonstration. But recent research in grades 4-8 has shown that effective teachers of mathematics spend more time in demonstration than do less effective teachers (Evertson et al., 1980;

Good and Grouws, 1979). For example, Evertson et al., (1980) found that the most effective mathematics teachers spent about 23 minutes per day in lecture, demonstration and discussion as against 11 minutes for the least effective teachers. The effective teachers are using this additional presentation time to provide redundant explanations, use many examples, provide sufficient instruction so that the students can do the seatwork with minimal difficulty, check for student understanding, and reteach when necessary.

What does one do in effective demonstration? Summarizing ideas from the research review of Brophy (1980), the experimental study by Emmer et al., (1982) and the study on teacher clarity by Kennedy et al., (1978) one can present the following suggestions for effective presentation:

- Presenting material in small steps

- Focusing on one thought (point, direction) at a time

- Avoiding digressions

- Organizing and presenting material so that one point is mastered before the next point is given

- Modeling the skill (when appropriate)

- Having many, varied, and specific examples

- Giving detailed and redundant explanations for difficult points

- Checking for student understanding on one point before proceeding to the next point

- Using questions to monitor student progress

- Staying with topic, repeating material until students understand

When demonstrations are not clear, the main problems appear to be not giving sufficient directions and explanations, assuming everybody understands because there are no student questions, and introducing more complex material before students have mastered the early material.

Although demonstration is a major part of instruction in areas such as mathematics, English grammar, reading decoding, science, and foreign language, there are some areas where, unfortunately, demonstration is infrequently used. Demonstration is infrequent when teaching reading comprehension or higher level cognitive thinking. Durkin (1978-1979; 1981) noted that there is seldom a demonstration phase in reading comprehension. She defined comprehension instruction as specific instruction by the teacher directed toward helping the student understand or work out the meaning of more than a single word. She distinguished comprehension instruction from comprehension assessment, in that comprehension assessment consisted of a teacher asking questions and telling students whether their answers were right or wrong. In her study, 24 fourth grade teachers were observed during the reading period for a total of almost 5,000 minutes (or almost 200 minutes per teacher). She found that comprehension instruction occurred less than one percent of this time. Durkin (1981) also inspected elementary reading textbooks to see if these books provided explicit demonstration on how to answer to comprehension questions. Again, she found a lack of explicit instruction in this area.

Similarly, although teachers are exhorted to ask higher level cognitive questions (i.e., questions which require application, analysis, and synthesis) teachers seldom demonstrate to their students how to answer such questions (nor are they taught how to provide this demonstration).

Instructional design. The field of instructional design involves research on how to design the presentation so that students can achieve mastery in the fewest number of trials and the smallest amount of time. In the elementary grades, good instructional design means that student errors and confusion is minimized and students receive explicit instruction rather than having to guess.

In a study of instructional design, Beck and McCaslin (1980) analyzed eight beginning reading programs to answer three questions:

- a) Were confusable letters, specifically b and d, taught at a wide temporal and sequential distance from each other (i.e., how many intervening graphemes were taught between these two letters and how much time elapsed between teaching these letters)?
- b) What is the potential effectiveness of each program for teaching either the short i or the short e sound?
- c) What is the likely effectiveness of the programs for teaching students to blend sounds?

The authors report on how the eight reading programs sequenced confusable letters, in this case, b and d. Research from 1962 (Gibson et al., 1962) indicates that confusable items should be taught separately. Despite the "obviousness" of the fact that confusable letters should not be taught at the same time, we see that three programs still taught b and d within a week of each other and with few graphemes (Table 2).

Table 2
Instructional Design

<u>Program</u>	<u>Elapsed time between b and d</u>	<u>Number of Intervene graphines</u>
Distar	half a year	27
Bank Street Readers	half a year	5
Merrill	one week	1
Open Highways	one week	1
Houghton Mifflin	one week	2
Sullivan	one month	4
Palo Alto	one month	4
Ginn	two weeks	8

3. Guided student practice.

In the successful experimental studies, the demonstration is followed by guided practice (or teacher-led practice). That is, the teacher asks questions and is also standing by to supply assistance and help, if necessary. This guided practice continues until the students are confident and firm.

This instructional function is usually performed by the teacher who:

asks a large number of questions

guides students in practicing the new material--initially using

prompts to lead students to the correct response, and later

fading prompts when students are responding correctly

checks for student understanding

provides feedback

corrects errors

reteaches when necessary

provides for a large number of successful repetitions

Frequent questions. Both correlational and experimental studies have shown that a high frequency of teacher-directed questions was important for acquisition of basic arithmetic and reading skills in the primary grades. Stallings and Kaskowitz (1974) identified a pattern of factual question-student response-teacher feedback as most functional for student achievement. Similar results favoring guided practice through teacher questions were also obtained by Stallings, et al (1977, 1979), Soar (1973) and Coker, Lorentz and Coker (1980).

During successful guided practice two types of questions were usually asked by the teacher: questions which called for specific answers, and those which asked for explanation of how an answer was found. Similar results on the importance of a high frequency of questions have been obtained in mathematics in grades 6-8. In a correlational study of junior high school mathematics instruction (Evertson, Anderson, and Anderson, 1980) the most effective

teachers asked an average of twenty-four questions during the 50-minute mathematics period, whereas the least effective teachers asked only 8.6 questions. (For each group the majority of the questions were factual, however, the most effective teachers asked twenty-five percent process questions--explaining how a result was obtained--whereas the least effective teachers only asked sixteen percent process questions.)

Two experimental studies (Anderson, et al., 1979 and Good and Grouws, 1979) used guided practice as part of the experimental treatment. In each study, the teachers who received the additional training were taught to follow the presentation of new material with guided practice. The practice consisted of students responding to teacher questions and doing exercises on their own. In each study, the teachers in the trained group asked more questions and had more guided practice than did the control teachers who continued their normal teaching. And, in each study, the students in the experimental groups had higher achievement than the students of teachers in the regular, control groups. Furthermore, the Anderson et. al., study found strong positive correlations between student achievement and the amount of time spent in question-answer format and between student achievement and the number of academic interactions per minute. Thus, it is not only useful to spend a lot of time in guided practice, it is also valuable to have a high frequency of questions and problems.

Of course, all teachers spend time in guided practice. However, the more effective teachers and their students spent more time in guided practice more time asking questions, more time correcting errors, more time repeating the new material which was being taught, and more time working problems under teacher guidance and help.

The importance of frequent practice. Note that in all these studies, the consistently positive results are not being obtained merely by the type

of teacher question being asked but by the frequency of direct, convergent teachers questions and by the frequency of student responses. Elementary students need a great deal of practice, and factual, convergent questions provide a form of controlled practice whose frequency has consistently been correlated with student achievement.

Frequency is particularly important in primary grades because no matter how quick a learner is, it takes a large number of repetitions before s/he can recognize words rapidly. For example, Beck (1978) showed that among first grade children, words that were recognized in less than 4 seconds appeared more than 25 times in the instructional materials, whereas words which were recognized in 5 seconds or longer appeared less than 10 times.

Friends of mine have a 4 1/2 year old son who taught himself simple addition at the age of four. If you ask him to add $5 + 3$ or $8 + 5$ he can do it, and without mistakes, but it takes him a long time. Even this genius needs frequent practice before he becomes fluent.

Frequency, in another form, is also important for adults. Kulik and Kulik (1979) found that in college classes which had weekly quizzes scores on final examinations were almost invariably better than they were in classes which had only one or two quizzes during a term.

High percentage of correct answers. Not only is the frequency of teacher questions important, but the percentage of correct student responses is also important. One of the major findings of the BTES study (Fisher et. al., 1980) was that a high percentage of correct answers (both during guided practice and when working alone) was positively correlated with achievement gain. Similarly, Anderson et. al., (1979) found that the percent of academic interactions where the student gave the correct answer was positively related ($r = .49$) to achievement gain.

More specific information can be obtained from studies which compared the most effective and least effective classrooms. For example, in the study by Anderson et. al., (1979) the mean percentage of correct answers during reading groups was 73 percent in the treatment teachers' classrooms but only 66 percent in the control classrooms. Gerstein, Carnine, and Williams (1981) found that teachers using the Distar program who obtained high reading achievement from their students had student accuracy rates near 90 percent whereas those with lower class achievement had accuracy rates of less than 75 percent. In a correlational study in fourth grade math, Good and Grouws (1976) found that the most successful math teachers had a success rate of 82 percent whereas the least successful had a success rate of 76 percent. However, this result was not replicated in a study of Junior High School math (Evertson, Anderson, Anderson, and Brophy, 1980).

Overall, a high frequency of correct responses from all students is particularly important in the elementary grades. The one exception to this statement occurred in 7th and 8th grade mathematics.

This principle, a high percentage of correct responses given rapidly and automatically, is a relatively new finding in research on classroom instruction. We can probably never give specific answers on how high this percentage should be. As a reasonable benchmark for now, one could recommend that the success rate be about 80 percent when students are working on new material; during reviews, students' responses should be rapid, smooth, and almost completely correct (perhaps 95% correct).

How do some teachers obtain high success rates? The answers are suggested from the previous discussion, namely:

- presenting materials in small steps
- directing initial student practice through questions
- continuing practice until students are firm

overlearning

frequent review

Of all the above variables, two seem most important. The effective programs and the effective teachers teach new material in small steps so that the possibility for errors is lessened, and they practice to overlearning--that is, they continue practice beyond the point where the children are accurate. For example, in the ECRI programs (Reid, 1980) there is daily review of the new words in the stories that have been read and will be read. Students repeat these words until they can say them at the rate of one per second. In the Distar program (Becker, 1977) the new words in any story are repeated by the reading group until all students are accurate and quick. In the Instructions to teachers in their experimental study on primary reading groups, Anderson, Evertson, and Brophy (1979) stressed the importance of overlearning and making such that each student "is checked, receives feedback, and achieves mastery." All of the above procedures, which facilitate obtaining a high success rate, can be used with any reading series.

Checking for understanding. Guided student practice also includes teacher "checking for understanding." This refers to frequent assessments of whether all the students understand the content or skill being taught or the steps in a process (such as two digit multiplication).

Checking for understanding appears in the teacher training materials developed by Madeline Hunter (Hunter and Russell, 1977), has a prominent place in the teacher's manual developed for the Missouri Mathematics Effectiveness Project (Good and Grouws, 1979) and appears in the manual "Organizing and Managing the Junior High Classroom (Emmers, Evertson, et al., 1981).

It is best that checking for understanding take place often and frequently so that the teacher can provide corrections and do reteaching when necessary. Because checking for understanding involves teachers asking questions, it is

best that these questions be prepared beforehand. Some suggestions for conducting checking for understanding include:

- prepare a large number of oral questions beforehand
- ask many brief questions on main points, supplementary points,
and on the process being taught
- call on students whose hands aren't raised
- have all students write answers (on paper or a chalkboard) while
the teacher circulates
- have everyone write the answer and check their answers with a
neighbor (usually with older students)
- at the end of a lecture/discussion (usually with older students)
write the main points on the board and have the class meet
in groups and summarize the main points to each other.

The wrong way to do checking for understanding is to ask a few questions, call on volunteers to hear their (usually correct) answers, and then assume that all the class either understands or has now learned from hearing the volunteers. Another error is to ask "are there any questions?" and, not hearing any, assuming that everybody understands. The teacher's error, in the above cases, was in not having prepared enough questions (or problems) to use in checking for understanding. It is recommended that these questions be prepared beforehand, when the lesson is being prepared. A third error (particularly with older children) is assuming that one does not need to check for understanding, that simply repeating the points will be sufficient.

Calling on individual students. First in a correlational study (Brophy and Evertson, 1976) and then in an experimental study (Anderson, Evertson and Brophy, 1979) it was found that in primary grade reading groups it was better for student achievement if the teacher called on students in ordered turns. Such ordered turns were for reading new words and reading a story out loud.

In explaining the results, the authors say that ordered turns insure that all students have opportunities to practice and participate, and ordered turns simplify group management by eliminating hardwaving and other student attempts to be called on by the teacher.

In each study, student call-outs were usually negatively related to achievement gain. However, for the lower achieving students in these studies, student call-outs were positively related to achievement. This supports Brophy and Evertson's (1976) conclusion that it is best to get low achieving students to respond in any fashion. However, due to the lack of other studies in this area, these results are tentative.

Anderson, Evertson, and Brophy (1982) note that although the principle of ordered turns works well in small groups, it would be inappropriate to use this principle with whole class instruction in most situations. They suggest that when a teacher is working with a whole class it is usually more efficient to select certain students to respond to questions or to call on volunteers than to attempt systematic turns.

Group responding. One technique for obtaining a high frequency of responses in a minimum amount of time is through group responding (see Becker, 1977). This technique is particularly useful when students are learning material which needs to be overlearned, such as decoding, word lists, and number facts.

Two successful programs, Distar (Becker, 1977) and ECRI (Reid, 1978-1982) make extensive use of choral responding in primary grade reading groups. In these programs, choral responses are initiated by a specific signal from the teacher so that the entire group will respond at the same time (much like a conductor and an orchestra). When the teacher does not provide training and does not insist that students respond in unison, there is the danger that

the slower students may delay their responses a fraction of a second and echo the faster students, or they may not respond at all.

Becker (1977) argued that choral responding (to a signal) a) allows a teacher to monitor the learning of all students effectively and quickly, b) allows the teacher to correct the entire group when an error is made, thereby diminishing the potential embarrassment of the individual students who make errors, and c) makes the drill more like a game because of the whole group participation. The Oregon Direct Instruction Model suggests that teachers use a mixture of both choral responses and individual turns during the controlled practice phase, with choral responding occurring about seventy percent of the time. The individual turns allows for testing of specific children. If the slower children in the group are "firm" (i.e., quick and confident) when questioned individually the teacher moves the lesson forward; however, if they remain slow and hesitant on the individual turns, then this is a signal that the children need more practice. In this case, it would also be argued that because the hesitant children from the individual turns were in a homogeneous group, it is likely that the other children could also benefit from the additional practice.

Group responding, in unison and to a signal, is also used successfully in the ECRI program. In ECRI it is used for learning new words, and for reviewing old words of up to 100 words. With this training students learn to read the list of new words at a speed of one word per second.

Choral responding works best in small groups--such as reading groups--where the teacher can monitor the responses of individual students. Group responding is also used with the whole class in primary grade mathematics when students are reviewing number facts such as multiplication tables.

4. Feedback and Correctives.

A major teaching function is responding to student answers and correcting student errors. During guided practice, during checking for understanding, and during review, how should a teacher respond to a student's answer?

Simplifying a bit, there are four types of student responses:

correct--and quick and firm

correct--but hesitant

incorrect--but a "careless" error

incorrect--suggesting lack of knowledge of facts or a process.

Correct, quick, and firm. When a student response is correct, quick, and firm, (usually occurring in the later stages of initial learning or in a review) then the research suggests that the teacher simply ask a new question, thereby maintaining the momentum of the practice. There is also value in short statements of praise (e.g., "very good") which do not disturb the momentum of the lesson.

Correct, but hesitant. This would probably occur during the initial stages of learning (e.g., guided practice and checking for understanding) or during a review of relatively new material. In this case, it is suggested that the teachers provide short statements of feedback (e.g., "correct," "very good"). It is also suggested that the teacher provide moderate amounts of process feedback, that is, re-explain the steps used to arrive at the correct answer (Anderson, Evertson, and Brophy, 1979; Good and Grouws, 1979). Such feedback may not only help the student who is still learning the steps in the solution, but it may also aid other students who need this information to understand why the answer was correct.

Incorrect but careless. When a student makes a careless error during review, or drill, or reading, then simply correct the student and move on.

Incorrect but lacking in knowledge of facts or a process. Student errors during the early stages of learning new material indicate the student is not firm in the facts or process being taught. One approach to these errors is to help the student by providing hints and/or asking simpler questions (Stallings and Kaskowitz, 1974; Anderson, Evertson, and Brophy, 1979). This approach seems useful when the student can correct the error rather quickly (e.g., 30 seconds or less).

Another approach to student errors is to reteach the material, re-explaining the steps used to reach the correct answer. Good and Grouws (1979) instruct teachers to reteach when the error rate is high during a lesson. Reteaching, particularly during the initial stages of learning new material, is recommended by Becker (1977) and by Reid (1980), and each of these programs provide specific correction procedures for the teacher to use. The Distar program not only specifies correction procedures but also specifies additional teaching to "firm up" the student in any area of weakness.

Whether one uses hints or whether one reteaches the material the important point is that errors should not go uncorrected. When a student makes an error, it is inappropriate to simply give the student the answer and then move on. It is also important that errors be detected and corrected early in a teaching sequence. If early errors are uncorrected they become extremely difficult to correct later and systematic errors (or misrules) can interfere with subsequent learning.

In their review on effective college teaching, Kulik and Kulik (1979) found that instruction was more effective when (a) students received immediate feedback on their examinations, and (b) students had to do further study and take another test when their quiz scores did not reach a set criterion. Both points seem relevant to this discussion: students learn better with feedback--as immediate as possible; and errors should be corrected before they become hardened.

5. Independent Practice.

During the guided practice, students (a) begin to work the new problems or apply the new skills, (b) receive additional process explanations, if necessary, and (c) receive corrections and reteaching when necessary. When the guided practice is successful, the students can now move into independent practice.

During independent practice the students usually go through two stages: unitization and automaticity (Samuels, 1981). During unitization the students are putting the skills together. The students make few errors, but they are also slow and have a good deal of energy toward accomplishing the task. After a good deal of practice the students achieve the "automatic" stage where they are successful and rapid and no longer have to "think through" each step. When students are learning two digit multiplication and are hesitantly working the first few problems, the students are in the unitization phase. When they have worked sufficient problems correctly, so that they are confident, firm, and automatic in the skill, then the students are in the automaticity phase.

It is important to continue independent practice so that there is overlearning--that is, the students are working a large number of problems successfully. This overlearning is particularly important in hierarchical material such as mathematics and elementary reading. Unless there is overlearning to the point of automaticity, it is unlikely that the material will be retained.

The advantage of automaticity is that students who reach it can now give their full attention to reading comprehension or math problem solving. Thus, when learning new material, it is important that students continue their practice to the point of overlearning, to the point where they are rapid, quick and firm in their responses.

Managing students during seatwork. The most common context in which independent practice takes place is in individual seatwork. Students in grades one through seven spend more time working alone at seatwork than any other activity (approximately 50 to 75 percent of their time) (Fisher et al., 1978; Stallings and Kaskowitz, 1974; Stallings et al., 1977; Evertson et al., 1980). However, they are less engaged during seatwork than when they are in groups receiving instruction from the teacher. Therefore, it is important to learn how to maintain student engagement during seatwork.

Student engagement during seatwork is usually increased by the following instructional procedures:

- More time is spent in lecture, discussion, and guided practice,
- that is, more time is spent preparing the students for seatwork
- The teacher structures the seatwork and directs the class through the first seatwork problems
- Seatwork follows directly after the guided practice
- The seatwork is directly relevant to the demonstration and guided practice
- The teacher actively circulates during seatwork, providing feedback, asking questions, and giving short explanations.

One finding is that teachers whose classes were more engaged during the seatwork prepared these classes for the seatwork during the demonstration and guided practice. Evertson, Emmer, and Brophy (1980) found that most effective teachers in junior high mathematics spent 24 minutes (in a fifty minute period) in demonstration and guided practice, whereas the least effective teachers spent only ten minutes on these same activities.

A major finding of Fisher et al (1978) was that teachers who had more questions and answers during group work had more engagement during seatwork. That is, another way to increase engagement during seatwork was to have more

teacher-led practice during group work so that the students could be more successful during the seatwork. Successful teachers also had the students work, as a group, on the first few seatwork problems before releasing them for seatwork (Anderson, Evertson, and Brophy, 1979). The guided practice of Hunter and Russell (1977) and of Good and Grouws (1979) are additional examples of the importance of teacher-led guided practice before seatwork.

In summary, seatwork activities take place in all classrooms. But the successful teachers spent a good deal more time than did average teachers in demonstrating what is being taught and in leading the students in guided practice. Students who are adequately prepared during the teacher-led activity are then more able to succeed during the seatwork. In contrast, the less successful teachers spent less time in demonstration and guided practice and relied more on self-paced, "individualized" materials.

A second finding is that teachers who are successful managers of seatwork are actively circulating, asking questions, and giving explanations during seatwork. Fisher et al (1978) found that when students have contacts with the teacher (or another adult) during seatwork their engagement rate increases by about 10 percent. Teachers moving around and interacting with students during seatwork is also an illustration of the "active teaching" which was successful in the experimental study of Good and Grouws (1979). The advantage of a teacher circulating and monitoring during seatwork led Good and Grouws (1979) to advocate teaching the class as a whole for 4th to 8th grade math. Such whole class teaching permits the teacher to actively circulate and interact during seatwork.

When teachers are monitoring students during seatwork, how long should the contacts be? The research suggests that these contacts should be relatively short, averaging 30 seconds or less (Evertson et al, 1980). Longer contacts appear to pose two difficulties: the need for a long contact suggests that

the initial explanation was not complete; and the more time a teacher spends with one student, the less time there is to monitor and help other students.

A third finding (Fisher et al, 1978) was that when teachers had to give a good deal of explanation during seatwork, then student error rates were higher. Having to give a good deal of explanation during seatwork suggests that the initial explanation was not sufficient or that there was not sufficient practice and corrections before seatwork. The finding by Evertson et al (1980) that long contacts during seatwork were negatively related to achievement suggests a replication of this negative correlation.

Another effective procedure for increasing engagement during seatwork was to break the instruction into smaller segments and have two or three segments of instruction and seatwork during a single period. In this way, the teacher provides an explanation (as in two-digit multiplication), then supervises and helps the students as they work a problem, then provides an explanation of the next step, and then supervises the students as they work the next problem. This procedure seems particularly effective for difficult material and/or slower students. This practice was advocated in the manual for teachers in the successful Junior High School Management Study (Emmer et al, 1982) and characterized successful teachers of lower achieving students in junior high math classes (Evertson, 1982).

Other ways of accomplishing the independent practice function. The goal of independent practice is to provide overlearning and to provide sufficient practice so that students are quick, confident, and firm. As noted above, a major setting in which this function takes place is individual seatwork. However, there are other ways in which this function can take place. Three of these are discussed below: teacher-led practice, independent practice with a routine of specific procedures, and student cooperative practice in groups.

In the elementary grades, independent practice is often teacher-led. For example, if a teacher is leading a review of word lists, letter sounds, or number facts this activity can be called independent practice if the children are at a high success level and do not require prompts from the teacher.

In her study of successful teachers of lower-achieving Junior High English classes, Evertson (1982) found that the teacher who had the highest engagement rate had very brief seatwork activities. The material was presented through short teacher presentations and this was followed by long periods of repeated questions where the participation of all students is expected, the questions are narrow and direct, and there is a high degree of student success.

The ECRI program (Reid, 1978-82) obtains high engagement by organizing routines to be followed when practicing each story. During independent practice each student works, independently, on a story for which s/he is trying to achieve "mastery." To achieve mastery a student has to:

- a) read all new words in the story at a rate of 1 per second or faster
- b) spell all new words without error
- c) read any selection in the story at a predetermined rate
- d) answer comprehension questions on the story.

During independent study students proceed through a checklist of tasks relevant to these skills. They use a stop watch or the clock to time themselves. When they are ready, one student gives a spelling test to another, checks another student for accuracy and speed of the word list, and/or checks another student for accuracy and speed on the reading selection.

There are noteworthy advantages to these ECRI procedures. First, these are a series of tasks which can be readily followed because they are repeated for each story. Therefore, the teacher is not faced with the typical problem of having to prepare students for a different worksheet each day. Second, the tasks are designed to insure that all students receive sufficient practice and obtain a high level of automaticity. Third, the student interaction provides a social dimension to this task, allows a student to get help from another student, and yet, keeps the students focused on the academic task. I believe that many of these ECRI procedures could be incorporated into existing programs. In particular, teachers might consider the repeated reading until the students are reading rapidly and the student cooperative work.

Students helping students. Researchers have also developed procedures for students to help each other during the seatwork (Johnson and Johnson, 1975; Sharan, 1976, 1980; Slavin, 1980). In some cases the students in the groups prepare a common product, such as the results of a drill sheet (Johnson and Johnson, 1975), and in other situations the students study cooperatively in order to prepare for the competition which will take place (Slavin, 1980). Research using these procedures usually shows that students who do seatwork under these conditions achieve more than students who are in regular settings. Presumably, the advantages of these cooperative settings comes from the social value of working in groups, and the cognitive value gained from explaining the material to someone and/or having the material explained to you. Another advantage of the common worksheet and the competition is that it keeps the group focused on the academic task and diminishes the possibility that there will be social conversation.

In summary, the purpose of independent practice is to provide the students with sufficient practice so that they can do the work automatically. This is usually done by having students work, alone, at seatwork. Four research suggestions for improving student engagement during seatwork are:

- 1) The need for clear instruction--explanations, questions, and feedback--and sufficient practice before the students begin their seatwork. Having to provide lengthy explanations during seatwork is troublesome for the teacher and for the student.
- 2) Circulate during seatwork, actively explaining, observing, asking questions, and giving feedback.
- 3) Have short contacts with individual students (i.e., 20 seconds or less).
- 4) For difficult material, have a number of segments of instruction and seatwork during a single period.

Although the most common organization of independent practice is seatwork with each child working alone, three other forms of organization have been successful:

- 1) teacher-led student practice, as in drill
- 2) a routine of student activities to be followed during seatwork where the student works both alone and with another students, and
- 3) procedures for cooperation within groups and competition between groups during seatwork.

6. Weekly and monthly reviews.

The learning of new material is enhanced by weekly and monthly reviews. Many of the recent instructional programs include periodic reviews and also provide for reteaching in areas in which the students are weak. In Missouri Math (Good and Grouws, 1979) teachers are asked to review the previous week's work every Monday, and to conduct a monthly review every fourth Monday. The review provides additional teacher checking for student understanding, insures that necessary prior skills are adequately learned, and the review is also a check on the teacher's pace. Good and Grouws recommend that the teacher proceed at a fairly rapid pace (to increase student interest) and suggest that if a teacher is going too fast, the weekly review will reveal it.

Periodic reviews and recycling of instruction when there are student errors have been part of the Distar program since 1968. Extensive review is also built into the ECRI program in that slower students are reviewing new words for three weeks before they encounter the words in a story in a reader. The need for massed learning followed by spaced reviews is also part of Hunter's program on increasing teaching effectiveness (Hunter, 1981).

Management functions. Many of the programs cited on the first page also contain suggestions for managing transitions between activities, setting rules and consequences, alerting students during independent work and holding them accountable, giving students routines to follow when they need help but the teacher is busy, and other management functions.

The developers of these programs understand that instruction cannot be effective if the students are not managed. However, discussion of these functions in a separate area will probably appear in the paper by Brophy (1982).

Discussion

This paper has covered a number of teaching functions: review of previous learning, demonstration of new material, guided practice and checking for understanding, feedback and corrections, independent practice, and periodic review. As I wrote this paper I became impressed with the fact that different people, working alone, came up with fairly similar solutions to the problem of how to effectively instruct a classroom of 25 children. The major authors cited on the first page are more similar than they are different. The fact that these people, working alone, have reached similar solutions and have student achievement data to support their positions helps validate each research study.

One advantage of this paper is that it provides a general view, an overview of the major functions in systematic teaching. What is missing, however, is the specific detail which is contained in the training manuals and materials developed by each of the investigators. I would hope that all teachers and trainers of teachers have a chance to study and discuss the individual training manuals.

These components are also quite similar to those used by the most effective teachers. All teachers have some of the skills discussed above. However, the specific programs and the elaboration of these components add to the repertoires of all teachers and provide routines, procedures, modifications, which are more than an individual teacher, working alone, could have thought of. All teachers have some of the skills listed above. The programs help bring this set of skills to a conscious level and help develop strategies for consistent, systematic implementation (Bennett, 1982).

Now that we can describe the major teaching functions, we can turn and ask whether there are a variety of ways in which some functions can be fulfilled. We have already seen that the independent practice function can be

met in three ways: students working alone, teacher leading practice, and students helping each other. (There are even a variety of ways for students to help each other.)

We have just begun to explore this issue of the variety of ways of meeting each function, and at present, no conclusions can be drawn on this issue. It may be that each function can be met three ways: by the teacher, by a student working with other students, and by a student working alone--using written materials or a computer. Right now, however, not all functions can be met in all three ways--and we are limited in our choices by the constraints of working with 25 students in a classroom, the age and maturity of the students, the lack of efficient "courseware" for the student to use when working alone, and the lack of imaginative routines which will keep students on task and diminish the lost time when students move from activity to activity. For example, although the idea of students working together during independent practice always existed "in theory", such working together was also associated with students being off task and socializing. We needed the routines developed by Slavin (1981), Johnson and Johnson (1975) and Reid (1981) before we could be confident that students would work together during independent practice and be on task. Similarly, although "checking for understanding" could "theoretically" be handled by students working with materials or by students working with other students, we do not have effective routines for enabling this to happen--at present--in the elementary grades.

In sum, now that we can list the major functions or components which are necessary for systematic instruction, we can turn to exploring different ways in which these functions can be effectively fulfilled.

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